From: Gray, David
To: Coleman, Sam
Subject: FW: Houston Chronicle -Failures of floating-roof oil tanks during Harvey raise concerns
Date: Thursday, October 12, 2017 8:58:46 AM

Failures of floating-roof oil tanks during Harvey raise concerns

October 11, 2017 Updated: October 11, 2017 5:30pm

By Jordan Blum

Photo: Tom Fox, MBR

IMAGE 1 OF 6

Large storage tanks in retention ponds are surrounded by rainwater left behind by Tropical Storm Harvey on Aug. 30, 2017, at ExxonMobil's refinery in Baytown.

As Hurricane Harvey swept across the Houston area, torrential waves of rain built on top of crude oil storage tanks at Valero Energy's Houston refinery, causing one of the roofs that float atop the oil to flip almost on its side and release more than 235,000 pounds of toxic vapors and other pollutants into the atmosphere.

The collapse at Valero was one of more than 15 floating roof storage tanks that failed during the record-setting storm, allowing a combined 3.1 million pounds of volatile chemicals to spew into the air across the region, according to reports the companies filed with environmental agencies. This series of failures, along with the breakdown of drainage systems designed to funnel water off the roofs, exposed the vulnerabilities of floating roof tanks even as climatologists warn that future storms will carry more rain as global temperatures rise and ocean waters warm.

The U.S. Environmental Protection Agency has launched an investigation into the Valero tank failure, which may include a broader inquiry into the potential weaknesses of floating roofs, but declined comment. Environmental

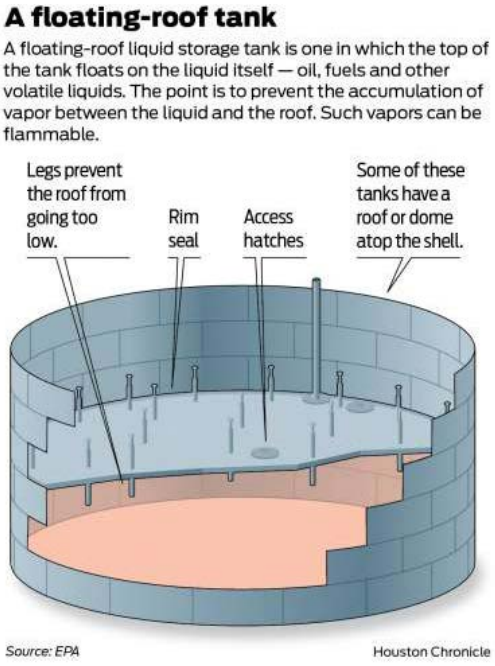
advocates and watchdog groups also have raised concerns about the roof failures, which exposed nearby residents to high levels of harmful emissions.

The Valero refinery, for example, is surrounded by the Manchester neighborhood in East Houston. When the floating roof collapsed during Hurricane Harvey, the company said, some 1,900 pounds of benzene, a volatile component of crude oil known to cause cancer, escaped into the air.

"The effects on the communities could be devastating," said Adrian Shelley, Texas director for Public Citizen. "There are homes that are literally in the shadows of these tanks."

Decades-old technology

About 400 of the more than 1,000 storage tanks in the Houston area employ floating roofs, but it is difficult to keep tabs on the exact figure because the number of tanks is expanding rapidly as the shale drilling boom transforms the Gulf Coast into hub for exporting crude, fuels and petrochemicals. The region's crude storage capacity alone has more than doubled in just six years, to more than 56 million barrels from 21 million, according to the investment research firm Morningstar.



Floating roof tanks are designed to reduce emissions by eliminating the buildup of vapors above volatile liquids, using decades-old technology for sealed roofs that float up and down on top of the liquid depending on levels in the tanks. The roofs have legs that prevent them from dipping too low into the tanks.

The tanks have drainage systems attached to the roofs that are supposed to funnel out rainfall and prevent too much from accumulating and weighing down the floating roofs. Rapid volumes of rain can cause the drainage systems to fail or simply overwhelm the roofs.

Most floating roofs are designed to hold up to 10 inches of rain without drainage. Harvey dropped more than 50 inches in some areas.

FAILURES OF FLOATING-ROOF TANKS

During Hurricane Harvey, there were more than 15 incidents of floating roofs failing atop oil storage tanks leading to more than 3.1 million pounds of potentially dangerous emissions. These notable incidents were reported by the industry.

- Magellan Midstream, 2 tanks, Aug. 31, Galena Park terminal, 2.47 million pounds of emissions from gasoline spills of nearly 11,000 barrels, which was initially estimated at just 1,000 barrels.

- Kinder Morgan, 3 tanks, Aug. 27 and 30, Pasadena terminal, nearly 260,000 pounds of emissions from problems including "partially submerged floating roof" issues.

- Valero Energy, 1 tank, Aug. 27, Houston refinery near Manchester neighborhood, more than 235,000 pounds of emissions from the "partial sinking" of a roof that was initially estimated at just 3,350 pounds.

- Enterprise Products, 1 tank, Aug. 31, Galena Park terminal, nearly 57,000 pounds of emissions when rainfall exceeded the capacity of the storage tank's roof drain.

- Royal Dutch Shell, 4 tanks, Aug. 28, Sept. 1 and Sept. 1, Deer Park and Port Neches, nearly 50,000 pounds of emissions from three tank issues in Deer Park and one in Port Neches, including issues from sinking roofs caused by "significant roof stress."

- Exxon Mobil, 1 tank, Aug. 27, Baytown, nearly 13,000 pounds of emissions when a "floating roof partially sank during the excess rain event from Hurricane Harvey."

- Flint Hills Resources, 1 tank, Sept. 5, Corpus Christi, more than 10,000 pounds of emissions from a vapor release with a floating roof tank during the refinery restart process after Harvey.

- Marathon Petroleum, 1 tank, Aug. 27, Texas City, nearly 8,000 pound of emission after a "roof was observed to be tilting … due to excessive rainwater."

- Phillips 66, 2 tanks, Aug. 27 and Aug. 30, Pasadena terminal, nearly 630 pounds of emissions from floating roof tanks affected by the storm.

Source: Texas Commission on Environmental Quality

Floating roof tanks also were responsible for the single-biggest spill of the storm. Some 11,000 barrels of gasoline - nearly 500,000 gallons - escaped from two storage tanks at the Galena Park storage complex of Magellan Midstream, an Oklahoma pipeline company. About 11,000 people live in Galena Park.

While the spill was largely contained to Magellan's property, much of the gasoline evaporated, releasing some 2.5 million pounds of pollutants into the air, including 13,000 pounds of benzene. The company says it's still investigating the exact cause of the tank failures.

"We will take the lessons learned from Hurricane Harvey and apply them to our natural disaster plan in the future," Magellan spokesman Bruce Heine said.

Several of the worlds biggest energy giants also suffered floating roof failures, including Exxon Mobil and Royal Dutch Shell, while Houston energy giants like Kinder Morgan, Enterprise Products Partners and Phillips 66 all reported similar incidents. All told, these tank failures led to the release of a combined 400,000 pounds.

Shell reported the most problems with floating roof tanks. Four were affected by roof collapses or drainage failures - three in Deer Park and one at Port Neches. One roof sunk, two others leaked from the stress of the rain, and a fourth sprung a hole in its roof drain.

"As always we are reviewing our practices and procedures following this event to look for ways to prevent future incidents," said Gary Guilhas, Shell's health, safety and environment manager at Deer Park, he added.

Todd Staples, president of the Texas Oil & Gas Association, a trade group, said the industry will conduct a review of tank failures and look for ways to improve the design standards and best practices for floating roof tanks. Still, he added, the region's petroleum storage complex proved itself safe and resilient, arguing the number of spills and leaks were minimal considering the massive storm.

"It's a false narrative to see the response and recovery as anything but remarkable," said Todd Staples, president of the Texas Oil & Gas Association. "This was the most catastrophic rain event in the history of Texas."

Time for a change?

Neither the state nor federal government have regulations that spell out specific design codes for floating roofs and their drainage systems, but the industry's leading trade group, the American Petroleum Institute, has published nearly 500 pages of recommended minimum standards for storage tanks. Following those standards, however, is voluntary. API declined a request for an interview.

A safer alternative to the floating roof tanks could be so-called all weather tanks, according to CB&I, an engineering and construction firm that describes itself as the energy industry's most experienced tank builder. The all-weather tanks, also know as internal floating roof tanks, included a fixed roof above the floating roof to protect it from the weather. However, at least a couple of Harvey's floating roof tank failures included internal roof tanks.

All-weather tanks cost 10 to 20 percent more than floating roof tanks, said Brad Veath, vice president of sales for steel plate structures at CB&I, which is headquartered in The Woodlands. Bigger and better drainage systems might also help avoid the roof collapses under extreme conditions such as Hurricane Harvey, environmental watchdogs said.

Floating roof tanks, of course, weren't the only ones that experienced during Harvey. The Arkema chemical plant in Crosby - prior to power failures and explosions - had two overflowing tanks. BASF, Huntsman and Occidental Petroleum all reported storage tank leaks at chemical plants in the Houston and Beaumont areas, and some other companies had smaller tanks that became unmoored or flipped over.

But floating roofs experienced problems most frequently, and their failures released the most pollutants.

Neil Carman, clean air program director for Lone Star Chapter of the Sierra Club, the national environmental advocacy group, called for thorough state and federal investigations into the problems experienced by floating roof tanks and stricter laws and regulations for designing and maintaining these tanks.

The roofs are simply not designed to handle as much water as Harvey dumped, Carman said, and the drainage systems proved inadequate. He added that the industry can't assume that a storm similar to Harvey won't hit the area again for many years.

"There's been a few problems in the past," Carman said, "but this time it's a much bigger issue than the industry has experienced."

From: Gray, David
Sent: Thursday, September 28, 2017 7:18 AM
To: Senn, John <Senn.John@epa.gov>; Miles, Erin <Miles.Erin@epa.gov>; Shiffman, Cari <Shiffman.Cari@epa.gov>
Cc: Grantham, Nancy <Grantham.Nancy@epa.gov>
Subject: FW: Houston Chronicle
I need a little help with the Chronicle question about NAA in Texas. Can someone help me out? His deadline is today.
David

From: Blum, Jordan D. [mailto:Jordan.Blum@chron.com]
Sent: Wednesday, September 27, 2017 2:50 PM
To: Gray, David <gray.david@epa.gov>
Subject: RE: Houston Chronicle
Thanks, I appreciate your patience.
I think this is my last question for now:
On this No Action Assurance requested by the state, “EPA will not pursue enforcement actions that relate to violations of the Clean Air Act for emissions of certain pollutants from gasoline storage tanks during events known as ‘roof landings.’”
Does this apply to the external floating storage tank incidents? I wasn’t sure what was meant by roof landings?

And does this apply to crude oil storage or petroleum products other than gasoline?
Lastly, what was the justification for this?
Thanks again

On Sep 26, 2017, at 4:17 PM, Blum, Jordan D. <Jordan.Blum@chron.com> wrote:

> I'm looking into the problems with leaks/emissions from external floating roof storage tanks during Harvey.
> I wanted to see if anyone from EPA who could be interviewed about the issues and what more can be done to secure these facilities before major storms?
> I'm at 713-362-3568.
> Thanks in advance,
> Jordan Blum
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